Alliance With Nature In the Adirondack Park

(And on the Rest of the Planet)

PAUL GUTMANN

Nature could have powered humans with the real zap of an atomic energy source instead of relying on wimpy stuff like peanut butter. Nature could have enabled humans to communicate via global telepathy instead of short-range speech. Who really cares? The all-powerful human *mind* has surmounted these and many other shortcomings of nature with nuclear power plants, the World Wide Web, etc. Nature isn't such hot stuff. On the other hand. . .

In his book entitled *The Body is the Hero*, Ronald J. Glasser asserts that although the men of medicine can work miracles, always — without exception — the human body must finish what the doctors started. Modern medicine can provide assistance, without which sometimes death would be certain, but, in the end, the body itself must annihilate the last invader and heal itself. Nature has kept the planet and the Adirondack region pristine since the beginning of time. Have you tripped over any dinosaur carcasses lately? That which has cleaned vast, diverse surfaces of land, oceans of water, and atmospheres of air for millennia inspires awe.

If mankind and nature seem to compete or seem to be adversaries from a technical point of view, the complex interrelationship of man and nature can often be incomprehensible from a socio-economic-political point of view.

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Third World countries feel the need to increase their populations so that cheap labor will be available to increase their gross national product. The president of the Sierra Club announced on national television that this organization's position on more stringent air quality standards was based on a consensus of the membership and would not be influenced by any facts found through scientific studies.

IT IS POSSIBLE TO PRESERVE THE ADIRONDACKS WITHOUT THE IMPOSITION OF A PLETHORA OF ENCUMBERING CONTROLS

The Adirondack Experience

People who live in the Adirondacks are special. Adirondack people edit, publish and write for the *Adirondack Journal of Environmental Studies*. People who live in the Adirondacks have grown up without neighbors on both sides, front and back, and even over and under. When you have ample elbow room, you do not need to adhere so strictly to the laws and rules that serve to lubricate the members of crowded societies preventing interpersonal friction. Natives of the Adirondacks (although I have only rarely heard this stated aloud) actually love the long, bitterly cold winters and the black flies for the demographic control that these hardships exert and the resultant peace and freedom of the uncrowded condition. The people of the Adirondack region do not want laws, rules, regulations, restrictions, fees, and other encumbrances and controls. However, nature, freedom and the spaciousness of their home are very precious to Adirondackers. For this reason, the control measures advocated by the preservationists would have some appeal to these residents if they thought that there was a possibility of actually losing what has always made their home unique. A native of Lake Placid once told me that development within the village limits could never be significant because virtually all the property within the village has already been developed. My reply was this: "Have you ever seen Manhattan?."

Our Alliance

Fortunately, it is possible (at least partially and perhaps entirely) to preserve the Adirondacks and, conceivably, the whole earth without the imposition of a plethora of encumbering controls. The possibility referred to is that of :

1. Understanding the concept of assimilative capacity.
2. Assisting and augmenting the self-purification and recycling systems of nature.
3. Converting waste into a resource.
4. Combining the above three items to produce innovative bio-technical solutions.

It is recognized that the black flies and the long, hard winters eventually may not be enough — especially since the black flies seem to be suc-

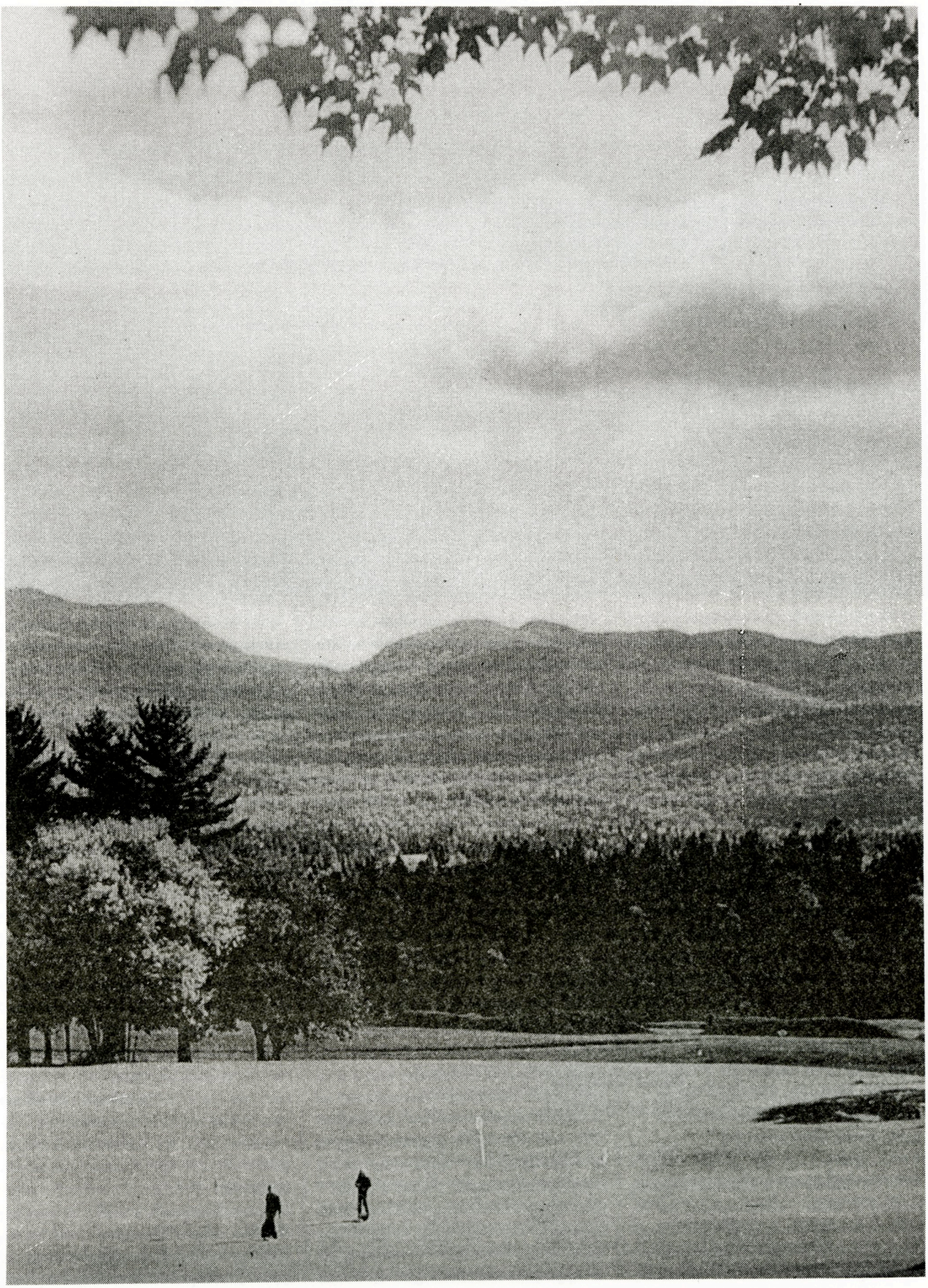

PHOTO BY PAUL GUTMANN

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cumbing to BTI (*Bacillus thurgensis israeliti*). The population will have to be stabilized as the assimilative capacity of our ecosystem must otherwise eventually be exceeded. Maybe I can whip off a technological rather than mandated plan for effective population stabilization the next time that I write. Wish me luck!

Discharges to the Chubb River, the Ausable River and Lake Champlain are presently approaching the assimilative capacity of these rivers and lakes. Phosphorus input to Lake Champlain must be reduced (See: Lake Champlain Management Conference, June, 1996, *Final Watershed Plan for Managing Lake Champlain*), and some improvement to the water quality in the Chubb River would be observed if ultimate oxygen demand (UOD) loads could be reduced. A significant contribution to the phosphorus and UOD load placed upon the Chubb River and ultimately upon Lake Champlain comes from the point source discharge of secondary treated effluent from the Lake Placid Village Wastewater Treatment Plant. The traditional solution would be to require Lake Placid Village to upgrade its existing secondary facility to a tertiary treatment plant. However, mandates are detested by Adirondack communities, and recent New York State legislation prohibits mandates without funding. Furthermore, tertiary treatment usually involves energy and chemicals whose production is fiscally and environmentally expensive. How would nature's own self-purification and recycling system, by contrast, meet this challenge?

A GLOBAL APPROACH WOULD BEGIN WITH THE PRINCIPLES OF REDUCING, REUSING AND/OR RECYCLYING THE EFFLUENT.

Civil engineers, aquatic scientists, and wastewater treatment professionals would design a traditional chemical system to treat the secondary discharge to meet tertiary effluent standards. A more global approach would begin with the principles of reducing, reusing and/or recycling the effluent. At Lake Placid, we always begin our planning and designing processes by *defocusing*. We try to define underlying causes, investigate all pertinent relationships, and, finally, attempt to view our task from the broadest possible perspective. Environmentally correct solutions are always sought, and simple solutions are always favored. Rube Goldberg designs receive consideration only as a last resort. It is surprising how the simple solution almost invariably returns to nature's way.

In the first stages of our deliberations — actually within minutes — the realization came to us that waters suffer from phosphorus and UOD enrichment only because low levels of free dissolved oxygen make water an incredibly sensitive environment. Water, actually, has a rather small assimilative capacity for phosphorus when compared with vegetated soils. Furthermore, vegetated soils can also assimilate large amounts of UOD, including nitrogenous oxygen demand (NOD), compared to what an aquatic

environment could assimilate. Phosphorus and the nitrogenous component of UOD enrich the water for plant growth; plants produce organic carbon which, upon decay, depletes the rather tiny amount of free oxygen in water; thus, the delicate balance of the aquatic environment is upset.

The growing of plants on land is not usually detrimental to the environment, but stimulating plant growth in water is rarely beneficial. Rather quickly and directly, it was concluded that the Lake Placid secondary wastewater effluent could be a resource rather than a pollutant if it could be directed toward agricultural ends. Not only would the phosphorus and nitrogen accomplish fertilization valuable to agriculture, but the water component itself would enable the crop to prosper despite drought. Admittedly, even the great master plan for the planet's own self-purification and recycling systems would have to struggle with removing the necessary amount of phosphorus and UOD from the water. Nevertheless, if we co-operate with Mother Nature by shifting the load from the water to the land, the situation changes entirely.

Tertiary Treatment Using Irrigation

Wastewater has a very successful and long history of being used for irrigation in regions with arid climates; but, in New York State, irrigation is not commonly practiced for a combination of climatic and economic reasons. However, if irrigation can simultaneously accomplish tertiary wastewater treatment, then the economics become very favorable in New York. More importantly, irrigation with secondary effluent offers more complete environmental gains than traditional tertiary treatment does.

There are farms that grow hay, potatoes, grains and occasionally other crops near enough to the Lake Placid treatment plant to utilize its secondary effluent for irrigation purposes; but, within 1500 feet of the plant outfall pipe in the Chubb River, there is a golf course that has always had to irrigate to maintain its tees, greens, and fairways. Because of its extreme proximity to the source of secondary effluent, the golf course became the most obvious choice to receive secondary effluent for irrigation. The irrigation of approximately one-half of the golf course (proposed project phase 1) would reduce the phosphorus loading on Lake Champlain by 0.38 metric tons/year which is 63% of the initial New York 5-year phosphorus reduction target for the Main Lake segment of the lake (See: *A Demonstration of Advanced Wastewater Treatment Utilizing Golf Course Irrigation at Lake Placid, New York*, A Proposal to the New York State Energy Research and Development Authority, December 1996).

In addition to buying water, golf courses also buy phosphorus and nitrogen fertilizer, paying an obvious monetary price. Not so obvious is the payment of a hidden environmental price which would include mining, processing, and transporting these mineral nutrients as well as potential pollution from non-point, excess fertilizer run-off. These same nutrients would be cost-free — both fiscally and environmentally — and supplied in more appropriate, more frequent low doses if applied as they naturally occur in secondary effluent irrigation water. Fertilizers applied in more frequent lower doses are more likely to be completely assimilated by the soils and plants instead of being partly lost and wasted in run-off.

Warm Feelings Vs. Hard Facts

Several years ago, Lake Placid Village wastewater treatment plant co-operated with the Ward Lumber Company to plan a research and development demonstration project for fertilizing a white pine plantation with biosolids from the wastewater treatment facility. Although this project involved a very small plantation, would have been environmentally very beneficial, and had tremendous potential for perfecting plans for full-scale forest land fertilization, a well-meaning but uninformed preservationist group incited negative public opinion which could not be effectively countered. Lake Placid and the lumber company did not ever carry out this demonstration project because they did not have the resources to counter the pre-established bias with fact. As soon as phosphorus loading on Lake Champlain became a timely issue, we knew that there could be an equally erroneous reaction to any secondary effluent re-use if irrigation were suggested as the best way to do tertiary treatment at Lake Placid. Our first thoughts were to make plans to educate the Village Board, the public-at-large, golfers, the golf course owner, and all the regulatory agencies. The Champlain Basin Program provided a small grant (EPA money) for a project that would encompass a demonstration site, an interpretive display, a seminar, a paper, news releases, etc. (This paper itself is actually part of this education outreach project.) The above-mentioned forest fertilization project experience has shown that it is extremely important to present the facts before opinions based on misinformation have been formulated.

The Nature of the Beast

Lake Placid's wastewater is strictly domestic as it receives no significant industrial contributions. Whereas industrial wastewater often contains toxic substances, domestic wastewater is never toxic. Domestic wastewater consists of food and animal wastes which are easily treatable using biological treatment processes. The continuing success of biological treatment is continuing proof that the wastewater is domestic and has no toxicity. No toxicity! What is non-toxic pollution? There are just three broad categories of pollution:

1. Toxic
2. Infectious
3. Nutritious

Toxic Pollution

Of course, toxic pollutants are substances that adversely affect living things. Some clearly toxic substances such as dioxin and plutonium kill in minute doses and maim in trace

amounts. Then there are those less toxic substances such as salt and alcohol that kill only in high doses and are actually necessary, beneficial, or even delightful to living things in moderate concentrations. When it is observed that some toxic substances like bleach, lye, and petrochemicals do find their way into domestic sewage, it must also be observed that the amounts — or more precisely, the concentrations — of these substances is such that their toxicity is lost and that, in dilution, they can become nutritious and beneficial to life. It is EXTREMELY IMPORTANT to note that environmentally responsible people DO NOT SEWER ANY TOXIC WASTES, unless this disposal option is determined to be environmentally safe and the most effectual means of disposal.

Infectious Pollution

Infectious pollutants are likely to be found in all wastewater except for the most toxic industrial wastewater. Infectious materials are substances that carry microbiological pathogens such as viruses, mycoplasmas, bacteria, protozoa, ova, etc. An infectious pathogen will reproduce within the body of the host so that minute amounts of infectious material can spread throughout, overcome, weaken and even kill living things. Although raw domestic wastewater is extremely infectious, secondary effluent is quite free of infectious contamination. The treatment process reduces the infectious nature of wastewater in three important ways.

First, infectious organisms usually cannot live for long periods outside the host. For example, the HIV virus is considered to lose its viability rather quickly once outside the human body. Under most conditions, the HIV virus will lose its ability to infect in minutes, but it is rather more stable in domestic sewage and has been found to remain viable for up to two hours in the more HIV-friendly environment of sewage. However, the secondary treatment process takes about ten hours, and, thus, HIV, as well as many other pathogens, will not survive this lengthy treatment process.

Second, the secondary treatment process is a biological process in which a powerful culture of wastewater-acclimated microbes, chiefly bacteria, are used to consume and decay pollutants. These microbes destroy pathogens, which are out of their element and cannot compete.

Finally, wastewater that is used where body contact occurs, such as for additions to bathing beach waters, must, in a final treatment process, be disinfected with toxic substances or radiation to kill any living pathogens that might have survived the time and competition of the secondary treatment process.

The secondary effluent that was used for two seasons to irrigate the Lake Placid turf grass demonstration site was not disinfected. It was felt that golfing, mowing, and even the act of irrigation itself did not pose nearly the same health threat as swimming and did not constitute a body contact situation any more than does the currently non-disinfected discharge to the Chubb River.

It is likely that secondary effluent used for golf course irrigation will have to be disinfected to guarantee public protection from infectious pollutants, but it is not clear what degree of disinfection will be deemed necessary. For potable water, disinfection must be rigorous enough to kill all coliform bacteria (indicators) and even to kill 99.9% of the extremely resistant *Giardia lamblia* cysts. For bathing beach and swimming pool purposes, *Giardia lamblia* kills are not required, and coliform bacteria must only be reduced to less than 2,400 organisms per 100 cc. There are no microbiological standards for irrigation water!

New York State regulators will have to formulate microbiological standards for the re-use of wastewater for irrigation purposes. The formulation of standards will have to consider public safety and fiscal cost as well as environmental cost. It seems that public safety will not necessitate potable water standards. It also seems that bathing beach standards would be overly conservative. It is clearly more dangerous to immerse oneself (a real possibility in the Chubb River which has received non-disinfected secondary effluent for years) than to receive an occasional sprinkle from a sprinkler or wet an extremity on a golf course where signage can effectively warn about the possible infectious nature of disinfected wastewater.

Disinfection will, no doubt, be carried out using sodium hypochlorite, which is the least expensive, commonly used disinfectant. The more disinfection that is required, the higher the expense will be. Regulators should be sensitive that disinfection expense must include environmental costs as well as the budget cost. Sodium hypochlorite manufacture causes

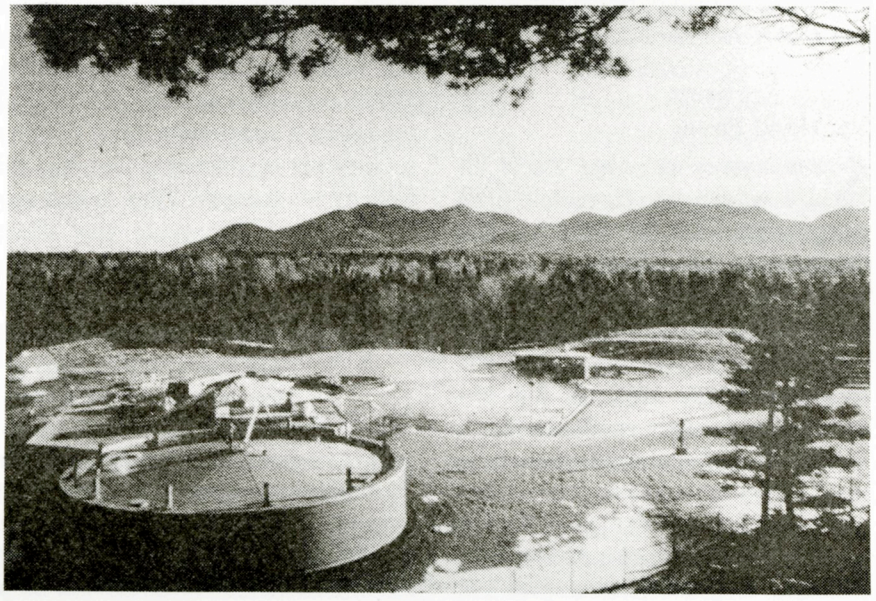

PHOTO BY PAUL GUTMANN

pollution. Also, this material will produce a small amount of toxic salt pollution in the wastewater that is used for irrigation. Some disinfection costs are necessary to protect public health, but over-protection should be avoided, and new, irrigation-appropriate standards should be developed to provide adequate protection without unnecessary costs.

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Nutritious Pollution

Nutrition or over-enrichment pollution occurs when there is simply too much of a good thing. Domestic wastewater contains carbohydrates, proteins and fats as well as all minerals and other micronutrients essential for adequate nutrition. The extremely nutritive nature of wastewater should not be surprising because the major contaminants in domestic wastewater are from food preparation and from food rejects from the kidneys and the alimentary canal (i.e., food inputs and food outputs).

Such a rich source of nutrients cannot be assimilated in an aquatic environment chiefly because the physical properties of water severely limit the amount of free oxygen available. In water bodies, free oxygen can reach a concentration in the order of 10 mg/l, while the atmosphere has a concentration of free oxygen in the order of 200,000 mg/l. Because there is ample atmospheric oxygen available for decay, forest floor litter, turf grass thatch, whole dinosaurs, etc., can decay and be naturally recycled without any ill effects so long as this material remains on the surface of the soil and does not find its way into rivers, lakes and ponds. Secondary wastewater treatment removes enough of the nutritive pollutants from wastewater so that those nutrients left can be assimilated with the small amount of free oxygen available in the receiving waters and be recycled naturally in the aquatic environment — despite the oxygen limitation inherent in water.

Granted, secondary treatment removes the nutritive contaminants that would nourish animals and other heterotrophs. However, the nutritive character of wastewater is complicated, and its effect on plants and other autotrophs needs to be considered. Secondary wastewater treatment removes the carbonaceous food that causes oxygen depletion in the aquatic environment of the receiving waters, but, recently, it has been realized that plant nutrients can indirectly cause oxygen depletion. If plants flourish due to enrichment with phosphorus and nitrogen, they fix inorganic carbon from carbon dioxide, and produce carbohydrates, proteins and fats. These plant-produced nutrients can be produced in quantities large enough to, upon decay, cause significant oxygen depletion in lakes. On the land, by contrast, soils have a very high physio-chemical affinity for phosphorus, and terrestrial plants will assimilate comparatively large amounts of both nitrogen and phosphorus.

Of course, this whole irrigation escapade could go horribly wrong because the golf course might become as slimy as fish and smell like sardines. Then pigs might fly! There are many professionals contributing to this project who foresee only complete success and great potential for an improvement of the lake, the river, the golf course, and for the economics of wastewater treatment. There exists a hardcover text titled *Wastewater Reuse for Golf Course Irrigation* by The United States Golf Association which attests to the successful history of similar undertakings. There were some who protested when the plans were announced for the small demonstration plot, saying that irrigation adjacent to the river might pollute the river. These harbingers of disaster were reluctantly calmed when reminded that all the secondary effluent presently is discharged directly into the river. The non-disinfected effluent is deemed river-safe. Also, there are those who feel that ground water may be compromised by the percolation of the irrigation water through the golf course soil. The water in the river bed itself is not prevented from percolation. This project has been and will continue to be scrutinized. To date, many benefits seem sure, and no deleterious effects can be predicted.

WE CAN UNIQUELY CO-OPERATE AND UNIQUELY ENTER INTO AN ALLIANCE ESTABLISHING NATURE AS PRINCIPAL PARTNER IN THE BUSINESS OF CONSERVATION AND SUSTAINABLE USE

The Moral of This Story

It is hoped that we will prove that the golf course owner, the municipal wastewater treatment plant operator, the state regulators, etc. can uniquely co-operate and uniquely enter into an alliance establishing nature as principal partner in the business of conservation and sustainable use. We believe that success at Lake Placid in forming this special alliance with nature can benefit the rest of the Champlain Basin because opportunities are quite universal for the conversion of secondary wastewater effluent from a waste stream into a valuable irrigation and terrestrial fertilization resource. ■

ILLUSTRATION BY ARTIST RYAN MURPHY, ENVIRONMENTAL STUDIES STUDENT AT ST. LAWRENCE UNIVERSITY